TRANSLATION

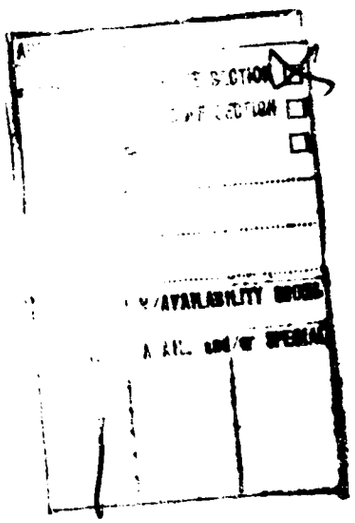
SCIENTIFIC TECHNICAL INFORMATION
(SELECTED ARTICLES)

FOREIGN TECHNOLOGY DIVISION

AIR FORCE SYSTEMS COMMAND

WRIGHT-PATTERSON AIR FORCE BASE

OHIO



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UNEDITED ROUGH DRAFT TRANSLATION

SCIENTIFIC TECHNICAL INFORMATION
(SELECTED ARTICLES)

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ORGANIZATION AND METHOD OF THEMATIC SEARCH AND CREATION OF INFORMATION PRECEDING NEW DEVELOPMENTS

G. I. Gol'dgamer

Resume

Described is the working experience of the branch of scientific technical information and technical economical investigations [ONTITEI] of the scientific research institute in the field of a thematic search of information to assure technological developments to research and investigations jobs, experimental structural developments carried out by the institute. Underlined is the importance of the leading information, the preparation of which proceeds the development and it shows a substantial effect on the selection of development trends. Discussed are problems of planning and methods of preparation: 1) retrospective thematical literature indications; 2) review; 3) bibliographic charts and annotations; 4) translations.

Each scientific investigation, new structural and technological development is preceded by a search and study of native and foreign scientific technical informations.

Our NII obtained every year 12,600 names of books, reports, descriptions of inventions for author certificates and patents and other sources of information with a general volume of 48 thousand literature authors.

The department of scientific technical information and technical-economical investigations (ONTITEI) of the institute publishes annually 400 author literatures of information materials (reviews of thematical indications of literature, translations, etc.) preceding new developments and in a majority unpublished. About 200 literature information we receive from without.

A simple calculation shows that the specialist of our NII would require to read more than 260 pages of machine text daily, in order to become acquainted within the period of the year only with a relatively narrow specialty with information which the institute obtained from abroad and publishes himself. In such cases, it would not have enough time for his own creative work.

From the enormous stream of information should be derived only that what represents interest from the viewpoint of development, intended by the annual plan of the NII and development perspectives of the branch. The obtained information should be freed from excessiveness by creating a secondary information of different degree of convolution with consideration of needs of concrete users. For this purpose our NII uses six of a certain type of "filters:"

1) by the catalogues "Soyuzpechat," prospects of publication and information organs in a book collection has been derived periodically

and continuing problems and books on NII profiles and by continuous theme;

2. the bibliography of ONTITEI yields information of basic technical trends of NII activity, using mainly bibliographic cards of VNITI of the All Union book office, etc.;

3. engineers - curators of ONTITEI receive information for use in concrete NIR and OKR;

4. technical informers of branches, labs, and workshops collect the incoming information dealing in the subject of their lab and workshop;

5. chiefs of distribution centers examine the obtained information and materials pertaining to concrete subjects, they control the workers for utilization;

6. finally, the developer, when studying the accumulated information, selects what is needed to his jobs for concrete development and simultaneously the thing what he needs: to increase his qualification and to broaden his mental outlook.

As a result, our NII requires quarterly from the incoming 2000 author literatures of primary foreign information only 2% for translation (35 - 40 author literatures); 0.3% (5 - 7 author literatures) are used in reviews and 0.4% (8 author literatures) in subject literature indicators, a total of only 3%. It should be considered that a part of scientific workers and engineers know the knowledge of scientific language in a sufficient degree and work on running foreign knowledge.

In consideration of this from foreign articles is quarterly derived approximately 5 - 6% of the content of their information. The activity of ONTITEI in preparing of convolute information for concrete NIR and OKR, as is reported by NII developers, allows them to free up to 30% of the time allotted for t e development of a subject, and to obtain information considerably faster and more complete then in the case if the search for information would be conducted by the developers themselves.

To assure developments, it is necessary, first of all, the leading information. To it we refer, first of all, descriptions of author certificates and patents. To leading information belongs also reading on previously executed works, dissertations, etc. We consider all this when we determine what sources of information should be studied. On each subject we search all sources of information, including the unpublished ones. But there are also sources of secondary information which we always investigate. They include: main systematic cards of our NII and of the central branch institute information, reference journals of VINITI, basic native and foreign patents, bibliographic publications, at the reports, intra book and book bibliography and others.

To the basic forms of information, preceding new developments, used in the process of investigation which are created by our ONTITEI as a result of search, analysis and generalization of accumulated information belongs reference and analytical narrow special reviews, translations, subject literature indicators, references, annotations, bibliographic cards, as well as albums of details, materials, instruments, equipment, compar-

ison tables, etc.

We begin new developments, as a rule, from a thematic search, selection, accumulation and editing of information which precedes developments. And so by preparation of information on the INR and OKR plan for 1964, engineers-curators and ONTITEI bibliographies began working already in October of 1963. Toward the beginning (or at the beginning) of new developments were prepared retrospective thematic literature indications with annotations and reviews constantly sonculted with the orderers corresponding to the NII subdivision. Parallel was carried out a search and accumulation of primary information on the subjects of developments.

The preparation of information on narrow subjects, the orderer agrees and leaves everything to ONTITEI, especially the technical tasks (form 1). This job is maintained by the chief engineer of the institute. The development of such a mission is connected with carrying out serious preparatory work. For example, on one subject intended for development for a period of three years, the chief of ONTITEI carried out a special report of engineers-curators and bibliographers in which the assistant of the main constructor of the subject announced:

1) problems and purposes of development; 2) what requirements are needed for the development and what should industry obtain as a result of the development; 3) with what methods the investigation will be carried on;4) what organizations and leading developers will participate in the development and who will handle what; 5) a detailed work program of the entire investigation.

Form 1.
I confirm chief engineer

Technical task

for the scientific technical information on the 1964 subject or its stage (name or number) department (lab)._____

1. Purpose of NIR or OKR _____

2. Basic technical requirements of NIR or OKR _____

3. Name of TUL or review _____

4. Basic departments of TUL or review in conformity with technical task or technical requirements of NIR or OKR _____

5. What kind of literature should be used: description of invention, report, readings, book, etc. _____

6. For what years the literature is needed _____

7. What pages or what countries _____

8. Executor _____

9. Time of execution _____

Chief of lab branch

Chief of INTITEI.

Only after all this does the chief of the development together with the lab of thematic search and use of information begin compiling the technical missions for information on this subject.

To realize timely and full thematic search of concrete subjects on the basis of technical missions, it is necessary to loose lots of work and the presence in the ONTITEI of qualified degrees and technical means for rapid multiplication of information (electrography, microfilming, and other functions).

Only on one subject has the ONTITEI realized a thematic search and gave the developers: 1 review, 6 thematic literature indications, 5 translations, 7 photocopies of reports and descriptions of inventions with author certificates and patents, obtained for the MBA, 82 by naming the primary information sources. On this subject the engineers, bibliographers, librarians, translators, editors, correctors, machine operators, and photographers spent about 200 working days. But sometimes as a result of thematic search at lesser time expenditures it is detected, that only one report was published on the subject. What value does sometimes a single report have (a single information) can be illustrated by such an example.

At the NII lab was conducted the development of a special installation. The investigation included two interconnected, but also, different subject trends:

creation of the very installation (which has been connected with the development of technical and theoretical problems);

Method of determining electric strength of materials.

An analogous installation was described in foreign literature only once. After selecting the block-diagram of the installation during the construction and adjustment of a series of units, partial problems ap-

peared. As a result of studying the literature, it was explained that similar type of work has not been conducted and that is why the search for information on this narrow special subject was made difficult. In this case was investigated interesting information on 20 partial problems whereby the data could be obtained when becoming acquainted with the information on an allied subject, even though at first galnce it often had no relation with the subject as a whole. In this way, it is apparent that by these 20 narrow special allied problems, the search and selection of data was only under the force of the developer and engineer-surator, working in contact with the investigator to whom the technical data are known and the operational calendar plan of the subject is known and he takes part in the development of individual stages and in the development as a whole.

In this connection, even one report may prove to have a substantial effect on the development process: one report on allied theme, detected by ONTITEI, enabled to develop after a series of failures the proper way to solve the problem.

Because of the absence in many knowledges of a system of timely creation and spreading of information preceding the developments, and also in connection with the insufficiently active activity of coordination centers in sending in information som etimes months do expire, and often for various reasons (mainly because of the absence of multiplication technique), the obtainment of information upon demand is very difficult.

Preparatory operations

Creation of information should be planned at all stages.

First, the ONTITEI reveals what information, preceding new developments, should be created. At the NII is set up an order in conformity with which the ONTITEI annually up to the 15th of October develops thematic plans of preparing various kinds of information, preceding new developments, in conformity with the project of annual theme plan of the NII and conforms with scientific-research and technological sub-units of the institute. Upon the order of the director of the institute, work on search, selection, and systematization of information, preceding new developments, are reflected in operational-calendar plans in the role of the first and individual stage with indications of the type of information, which should be prepared by the ONTITEI. It was established by this order that operational-calendar plans, especially in the part of preparing information of materials, are in conformity with ONTITEI leadership. About all new developments, the necessity of execution of which originates after affirmation of the annual theme plan, the planning-industrial branch informs the ONTITEI not later than within five days after receiving the mission.

Scientific-research departments, labs, and workshops get together once a year at the outset of the IV quarter, perfected norms are obtained by them (on ITR-days) and the cost (in rubles for entire forms) of information. After obtaining and studying the announcements of the

branches, labs, and workshops (form 2), the ONTITEI sub-units begin compiling annual thematic plans by their departments.

Form 2.

Statement for scientific technical information for 196... year, Department (lab) No. ....

1 Наименование темы	2. Виды информации (шифр)	3 Начало разработки	4 Ведущий разработчик	5 Трудоемкость НТР дни	6 Стоимость работы руб.

Branch chief (lab)

Technical informer.

KEY: 1 - name of subject; 2 - types of information (codes); 3 - start of development; 4 - leading development; 5 - labor effort ITR-days; 6 - work cost rubles.

The laboratory of thematic search and use of information compiles thematic plans for the preparation of retrospective thematic literature indicators and narrow special reviews (form 3 and 4). Creation of information preceding developments is included in operational-calendar plans with an indication of the compiler, difficulty (in ITR-days) and sum (in rubles).

Form 3.

Annual thematic plan for the creation of thematic literature indices

1 №№ п/п	2 Наименование темы	3 Номер заказа	4 Ведущий разработчик и номер телефона	5 Период охвата	6 Срок выполнения

KEY: 1 - No.; 2 - name of subject; 3 - number of order; 4 - leading developer and tel number; 5 - period of operation; 6 - time of execution.

Form 4.

Annual thematic plan of the creation of reviews

1 №№ п/п	2 Тема обзора	3 Шифр темы	4 Исполнитель (отдел лаборатория ОНТИТЭИ)	5 Срок представления обзора	6 Примечание

KEY: 1 - no.; 2 - theme of review; 3 - code of subject; 4 - executor lab department ONTITEI; 5 - time of representing review; 6 - remarks.

In the annual thematic preparation plan and creation of literature, chapter "A" provides for the creation of information, preceding new developments. In this chapter are included:

1) retrospective thematic literature indicators (volume and subject

are indicated);

2) reviews (volume and subject are indicated);

3) bibliographic cards and annotations on NII subject and allied problems (volume is only indicated);

4) translations (volume is indicated by the year, and subject by quarter).*

In quarterly plans of the editing bureau and monthly plans of editors are indicated concrete subjects.

Every month is compiled a preparation graph and an ONTITEI edition of information materials. In this graph is included information preceding the developments. A qualified scientific-technical editorship of such information has a substantial effect on the reduction of excessiveness in it.

Reviews which are a forerunner of new developments are discussed by individual specialists of our NII and other organizations and furnish us the conclusions.

Qualitative preparation of information preceding developments, are also provided by consultations from the orderers - laboratory chiefs and leading developers, for whom this information is being prepared.

This information, as a rule, bears an inverted nature. True, the degree of invertedness is different in such a case. The greater the degree of information invertedness, the lesser is the interest of the de-

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*For translations give subject per year is impossible, yes, and it is often inadvisable.

veloper from the view point of its utilization in concrete development but it always helps to derive the necessary information for analysis.

The process of preparing information, preceding developments, assures maximum fullest search of the thing, what has already been done in the world, thus liberating the developers, NII, and KB leaders from a greater amount of excessive information.

The developer should be convinced of the fact that beginning to realize a new theoretical constructural or technological development, he will not repeat, but will consider all, what appeared to this in world scientific technical literature pertaining to the given problem.

We have briefly explained the basic problems of organization work on the preparation and creation of information preceding new developments. We will try now briefly to explain a method for the creation of more important types of such information.

Retrospective thematic literature indicators.

Any investigation, structural or technological development, adoption of new chapters, good technology, labor organization, as well as solutions of many other problems, begins with the search of secondary information - retrospective thematic source indicator of primary information. This is the most inverted information because it indicates only subject, volume, and types of information without revealing its content.

A lesser degree of information invertedness is characterized by annotation of thematic indications of literature.

In conformity with the established annual thematic plan for the creation of thematic literature indications on concrete NIR and OKR literatures, the chief of laboratory thematic search and utilization of information establishes the executors from the number of engineers-curators, and bibliographers. Discussed here is the subject of the touched upon scientific research departments. After obtaining from the order the technical mission confirmed with the chief of ONTITEI and approved by the chief engineer of the NII and after defining this problem, the executors, first of all, check whether there is no ready indicator on the given subject.

For this purpose are provided compound catalogues of executed bibliographic informations, then secindary information - main systematic card catalogues (GSK), reference journals and bibliographic indices, the data of which are available in the GSK, systematic and alphabetic catalogues of scientific-technical libraries, special and auxiliary cards of ONTITEI, invited are organizations working on analogous subjects, etc.

In consequence of the investigation are derived available on the subject informations and a new secondary information is compiled.

The derived information is transmitted to the orderer for preliminary inspection, it is defined what information is of interest to him, and in dependence upon that further work is being prepared.

The thematic literature index prepared by the ONTITEI goes to the scientific-technical edition to the orderer or to another specialist, who then checks the correctness of selecting subject materials, correctness of translation of headings and compilation of annotations. After

making the necessary corrections, the bibliographic cards are numbered and the thematic index is directed for reprinting. At the end of the indicator is given a list of literature, used in compiling the index. The index is made in many copies and sent to the orderer at the branch information center and to other interested organizations and persons.

Referates and annotations.

In the process of systematic and thematic search, the engineers-curators compile according to the most primary domestic and foreign information annotations and references which are used in the role of independent operational type of information, when creating manifolds of references and referative reviews, and also for the supplementation of thematic portfolios (files).

Reviews.

Any scientific-research, planning-structural, or technological development should begin with the study and analysis of accumulated information about the state of the problem in the USSR and abroad, allowing to make a conclusion about the technical-economical advisability of the given development to properly select ways and considerably reduce their periods. For this purpose are compiled analytical reviews, the preparation of which appears to be an important stage in the development.

Compilation of narrow special and annual analytical reviews by the NII profile represents a serious scientific-research operation of thematic departments and ONTITEI.

Reviews of concrete subjects of annual NIR and OKR plans by the

institute are made by engineers-curators of ONTITEI. They all know foreign languages, they have higher engineering or linguistic education. Engineers-curators with language training work on definte problems for 8 - 13 years.

The annual analytical review is by them in combination with scientific research workers of branches and laboratories. Such reviews contain an analysis of the modern state and indicate wats of developing branches abroad and in the USSR.

The reference review announces information on general working trends of the undertaking on the developed or perspective subject. For such reviews are used prepared or selected ONTITEI brief references and annotations.

The work on preparation of reviews begins with an established order of theory creation.

Already in the fourth quarter of 1962, ONTITEI together with corresponding branches and NII labs began compilation of an analytical review for 1960 - 1962 by the basic thematic trends of NII activity and on the basis of known undertakings. The plan and periods compiling this review are confirmed mainly by the chief engineer of the institute.

In conformity with disposition of NII departments and laboratories should systematically develop such reviews. An industrially-planned department includes the development of compiling the review if quarterly plans of departments and laboratories.

The order of compiling annual analytical reviews is determined in

the following manner. The responsibility for search, selection, accumulation, and systematization of information is explained by ONTITEI. Realization for systematic analysis of the accumulated information, determination of station and direction of developments of corresponding at USSR and abroad, and preparations of annual reviews are carried out by branches and laboratories, which are combined with ONTITEI curators to represent materials for quarterly reviews, not later than the 15 - number of the first quarterly moment.

In conformity with the yearly thematic plan of creating narrowly specialized reviews, the authors present detailed plans to ONTITEI. In ratio to the preparation plans, the ONTITEI carries out a search, selection, systematization, and accumulation of secondary information on published and unpublished materials. The systematized data are analyzed and evaluated.

After this preliminary work, the author begins compiling the review. It eliminates the contradictions in available data, repetitions and errors, contained in preliminary informations. Compilation of data, available in various data sources and appearing in various times, explains the nature of the problem,(problems) and liberates the review from unnecessary data. If the review appears, a continuation of previously permitted, then we find a relationship between them, the basic conclusions are briefly explained, contained in a previous review, are pointed whether these conclusions are confirmed.

Each chapter of the review contains entire concrete data. In the

introduction, as a rule, is pointed the content of the review, the area of technology and time period, enveloped by the review. New discoveries and original technical solutions are explained in a possible detail.

In the review are given not only data obtained from corresponding sources, but also argumented by the author evaluation of values of these informations, indicated are general tendencies of the development of technology during the discussed period and given are recommendations of ways of development of technology in the given area.

If in the review are discussed native and foreign data, then a comparative evaluation is made of the attained of comparative level of technological development and a technical-economical analysis is given. In the review are given data characterizing the attainments in the area of theoretical and experimental investigations, new principles, and discoveries, interesting solutions of the scheme, original constructions, calculation and measurement methods, as well as formulas. Noticed are principal conditions (for example, resulting formula, new method, etc), indicated are the basic trends in the development of objects and their industry with concrete data (parameters of samples, scheme characteristics, constructions, materials, industrial technology, brief technical characteristic of apparatus and instruments, and areas of their application).

Departments of the review are illustrated by graphs, tables, and photos of the most interesting instruments, blocks, and units.

If the primary information has generalized data about the production of objects in the given area and technical-economical data,

they are also given in the review.

In "conclusion" are briefly formulated general conclusions and evaluations of the level of the problem development is given or of the given area and explained are considerations about the desired working trends.

Translations.

If the retrospective thematic literature indicator, annotation, references, and reviews appear a secondary information of different degrees of convolutions, then the translations appear to be a valuable primary information.

As a rule, when searching for information, preceding a new development, are first of all selected and translated descriptions of patent inventions and the most important reports from periodic publications. These types of primary information appear to be the most actual. Consequently, translations into Russian language of new foreign publications takes an important place in the work of ONTITEI.

The translation function requires a loss of labor of a greater number of coworkers of the information organization (translators, engineers, editors, correctors, machinists, etc).

Before making a declaration for translation, the orderer derives at the scientific-technical library or from the NBA an interesting publications and only after becoming acquainted with its content, he transmits the originals with a request for translation at the ONTITEI.

The translation request goes into the bureau where the foreign problem is studied, where it is checked, whether coordinating or other

organizations do not have a ready translation of the given publication. In the absence of the same, the leader of the bureau explains whether it is possible in the place of a coordinating or other organizations to have a translation (a written one) or to prepare a photocopy or to limit oneself to oral translation. From the journal obtained, according to the MBA, possibly on the day of obtaining the journal are made photocopies of the necessary report.

If lab co-workers do not know the given foreign language and an oral translation does not satisfy them, a written translation is made of the required publication. In the working process, the translator consults with the orderer or with the scientific-technical editor. After checking with the scientific-technical editor, the translation is again examined by the translator and by the office chief and it is transmitted for literature editing and multiplication.

The periods of executing translations is considerably reduced if the translator immediately prints the text of the translation on a writing machine within four intervals. The translator then checks again the text, adding the necessary corrections. In this example, a scientific-technical and literature editing is made, whereby the correction of the text by the translators and editors is made in different inks.

Thanks to such a working organization consisting of 160 literature authors of translations which the ONTITEI should prepare in 1963 a hundred author literatures were emitted to require in the first semi-annual period.

An analysis shows that 95% of the made translations constitute descriptions of inventions, lectures, and reports at international symposiums and conferences, reports from international periodic and continuing publications. This is mainly a preceding information or information of recently finished work. Naturally that such information represents for scientific-researchers and planning-constructural organizations a maximum value. Selection and analysis should be considered as an important and obligatory stage of any development.

Report submitted to editor's office on July 15, 1964.

FORCED INSTRUCTION OF A PERCEPTRON WITH THRESHOLD ELEMENTS

A. Z. Nepomnyashchiy and L. B. Nisnevich

Resume

Discussed are instruction devices - elementary perceptron by Rozenblat and a continuous perceptron, introduced into the report of L. B. Nisnevich with A - elements of threshold type in the condition of forced instructions. It is shown that the average reaction of the perceptron by Rozenblat on an appearing image depends (for image standardization) only upon scalar reproduction of the recognized image on images of the instruction series. For a continuous perceptron with A - elements of threshold type, an affirmation is proven about the possibility for given compact, nonintersecting classes of images to select a threshold so that the perceptron divided these classes.

At the beginning we will briefly describe the process of instructing the perceptron. Assuming on the area of used elements (s-elements)- "meshwork" is given an image f. The areas of the elements can be dif-

ferent point multitudes, but we will assume the meshwork as a section (0.1), because this limitation does not affect our reasoning and results; under the image we will understand a function f(x), given at [0.1]. The value of function f(x) is multiplied into the value of "bond function" $\varphi_i(x)$ and goes into the i-associative element (i-element). For fixed i function $\varphi_i(x)$ is a realization of a certain given accidental process. Signals, coming from all s-elements into the i-A-element are averaged, and the output signal of the A-element appears to be the signal $\mu_i = \sigma[\int_0^1 f(x)\varphi_i(x)dx]$, where $\sigma(y)$ - function, one and the very same for all A-elements. Then the signal μ_i is multiplied by the entire A-element, v_i - the average arithmetical of these products, equal $\mu_0 = \frac{1}{N}\sum_{i=1}^{N}\mu_i v_i$ where N is the general number of A-elements, directed into the R-element, which by sign μ_0 refers the image f(x) to this or another class. Depending upon the working condition of the perceptron, the weight of the A-elements change. We will discuss a method of forming weight of A-elements during the work of the perceptron in condition of forced instruction.

Assuming the appeared functions belong to a certain multitude F from L_2, and this multitude is divided into two F+ and F- classes. The functions, belonging to F+ will be designated by f+, and the functions from F- will be designated as f-; the first ones will be called positive and class F+ - a positive class, the second negative, and class F- - a negative class. When working under forced instruction of the perceptron appears function f(x), for which it is known in advance to what class it belongs. Assuming prior to showing the weight of the I A-element

equals v_i^0. After revealment, the new weight v_i is formed by the formula

$$v_i = \begin{cases} v_i^0 + \mu_i, \text{ если } f(x) \in F^+ \\ v_i^0 - \mu_i, \text{ если } f(x) \in F^-. \end{cases}$$

After recognizing the class of the image, the perceptron carries off $f(x)$ to F+, if $\mu_0 > 0$, and to F- - in opposite case. The perceptron is called instructed, if it properly recognizes the class of images from F.

Assuming into as instructing series (series of functions, revealed during the instruction), are included f_1^+, f_2^+, ... f^+m_1, f_1^-, ... $f m_2$ order of their revealment, apparently has no value. For simplicity, we will adopt the weight of A-elements for instruction with equal 0. Then after instruction

$$v_i = \sum_{k=1}^{m_1} \sigma \left[\int_0^1 f_k^+(x) \varphi_i(x) dx \right] - \sum_{k=1}^{m_2} \sigma \left[\int_0^1 f_k^-(x) \varphi_i(x) dx \right].$$

Now we need to determine a class of images $g(x)$. As said above, it is determined by the sign of the signal μ_0 where

$$\mu_0 = \frac{1}{N} \sum_{i=1}^{N} \sigma \left[\int_0^1 g(x) \varphi_i(x) dx \right] v_i - \\ - \frac{1}{N} \sum_{i=1}^{N} \left\{ \sum_{k=1}^{m_1} \sigma \left[\int_0^1 g \varphi_i dx \right] \sigma \left[\int_0^1 f_k^+ \varphi_i dx \right] - \right. \\ \left. - \sum_{k=1}^{m_2} \sigma \left[\int_0^1 g \varphi_i dx \right] \sigma \left[\int_0^1 f_k^- \varphi_i dx \right] \right\}. \qquad (1)$$

We will mention that if the meshwork of the perceptron is discrete, i.e., consists of a sufficient number of n s-elements, then the

corresponding values are calculated in the very same way, in this case

$$\int_0^1 f(x)\,\varphi(x)\,dx - \sum_{i=1}^{n} \frac{x_i \xi_i}{n}.$$

We will discuss types of perceptrons, different in the meshwork (discrete and continuous) as well as by the method of selecting an accidental bond function.

Elementary Rozenblat perceptron.

The meshwork of the elementary Rozenblat [1] perceptron is discrete, its elements are connected by "positive" and"negative" bonds with A-elements. If the S-element is not illuminated, then over the bonds is sent signal "0," if it is illuminated, then by positive bonds is sent signal "1" and by the negative bonds - signal "-1." Bonds of each element with s-elements are selected in the following manner: each bond with probability $\frac{1}{n}$ goes for any given one from the n-elements, but the number of the positive bonds is always (for all A-elements) equal to k_1, and the negative - k_2. For various A-elements bonds are selected independently. Function $\sigma(x)$ of A-elements of this perceptron - is threshold:

$$\sigma(x) = \begin{cases} 0, & \text{при } x < 0 \\ 1, & \text{при } x > 0. \end{cases}$$

After revealing the instructing sequence $f_1^+, \ldots f_m^+, f_1^-, \ldots f_{m_1}^-$, we must recognize the class of images g(x). Since the bonds for various A-elements are selected independently and in conformity with one and the same distribution of probabilities, then the dispersion

$$D^2\mu_0 = D^2\left[\frac{1}{N}\sum_{i=1}^{N}\mu_i v_i\right] = \frac{D^2\mu_i v_i}{N}.$$

By virtue of the Chebyshew inequality, the probability

$$p[|\mu_0 - E\mu_0| \geq \varepsilon] \leq \frac{D^2\mu_0}{\varepsilon^2} = \frac{D^2\mu_i v_i}{N\varepsilon^2}. \qquad (2)$$

From here comes the theorem (see also report [2]):

Theorem I. For any $\varepsilon > 0$ and $\delta > 0$ exists such an $N(\varepsilon, \delta)$, as $p(|\mu_0 - E\mu_0| \geq \varepsilon) < \delta$ for all $N > N(\varepsilon, \delta)$. To prove it is sufficient in the inequality (2) to write

$$N \geq N(\varepsilon, \delta) = \frac{D^2\mu_i v_i}{\varepsilon^2\delta}.$$

In this way, at a sufficiently greater number of A-elements, the characteristics of the perceptron are with all probability close to the characteristics of the "average" perceptron, which ascribes a mathematical expectation sign to the recognized image. These characteristics will be investigated by us. We will prove the following theorem.

Theorem II. In the case of an elementary perceptron by Rozenblat $E\mu_0$ depends only:

a) upon scalar products (in metrics L_2) (f_i^+, g), (f_j^-, g), $i = 1, 2, \ldots, m_1$, $j = 1, 2, \ldots$, of the recognized function per function of the investigated sequence:

б) от $\int_0^1 f_i^+ dx$, $\int_0^1 f_j^- dx$, $\int_0^1 g dx$.

Remark. Dependence b) is unessential since it is possible to investigate only images f, for which $\int_0^1 f(x)\,dx = 1$.

Proof. In view of the fact that for various A-elements, bond distribution are identical from equation (1), we obtain:

$$M\mu_n = \sum_{k=1}^{m_1} E\sigma\left[\int_0^1 f_k\,\varphi\,dx\right]\sigma\left[\int_0^1 g\varphi\,dx\right] - \sum_{k=1}^{m_2} E\sigma\left[\int_0^1 f_k^-\,\varphi\,dx\right]\sigma\left[\int_0^1 g\varphi\,dx\right], \qquad (3)$$

where $\varphi(x)$ - of the accidental bond functions.

We will discuss expression

$$\nu = E\sigma\left[\int_0^1 f\varphi\,dx\right]\sigma\left[\int_0^1 g\varphi\,dx\right] = E\sigma\left[\frac{\sum_{i=1}^{n} x_i\xi_i}{n}\right]\times$$

$$\times\sigma\left[\frac{\sum_{i=1}^{n} y_i\xi_i}{n}\right] = p\left[\sum_{i=1}^{n} x_i\xi_i > 0n,\ \sum_{i=1}^{n} y_i\xi_i > 0n\right].$$

We will mention that $\xi_i = \xi_i^{(1)} - \xi_i^{(2)}$, where $\xi_i^{(1)}$ is an accidental value, showing how many "positive" bonds come from this s-element to a certain A-element, and $\xi_i^{(2)}$ - the value, showing how many "negative" bonds go to the very same A-element; by virtue of the bond selection law $\xi_i^{(1)}$ and $\xi_i^{(2)}$ are independent; consequently,

$$\nu = p\left[\sum_{i=1}^{n} x_i\xi_i > 0n,\ \sum_{i=1}^{n} y_i\xi_i > 0n\right] -$$

$$-\sum p\left[\sum_{i=1}^{n} x_i\xi_i^1 = A_1,\ \sum_{i=1}^{n} y_i\xi_i^{(1)} = B_1\right]p\times$$

$$\times\left[\sum_{i=1}^{n} x_i\xi_i^{(2)} = A_2,\ \sum_{i=1}^{n} y_i\xi_i^{(2)} = B_2\right]. \qquad (4)$$

Summation in formula (4) is carried out by all A_1, A_2, B_1, B_2 at conditions $A_1 - A_2 \geqslant \theta_n$; $B_1 - B_2 \geqslant \theta_n$. Functions f and g - characteristic functions of multitudes of illuminated s-elements.

We will designate $f'(x) = f(x) - f(x)g(x)$, $g'(x) = g(x) - f(x)g(x)$. Then

$$\sum_{i=1}^{n} x_i\xi_i \cdot \sum_{i=1}^{n} x_i\eta_i = \sum_{i=1}^{n} x_i y_i \xi_i\eta_i + \sum_{i=1}^{n} x_i x_i \xi_i\xi_i + \sum_{i=1}^{n} y_i y_i \eta_i\eta_i + \sum_{i=1}^{n} y_i x_i \eta_i\xi_i,$$

$$P\left[\sum_{i=1}^{n} x_i\xi_i \geqslant \theta n, \sum_{i=1}^{n} y_i\eta_i \geqslant \theta n\right] = \sum_{(M)} P\left[\sum_{i=1}^{n} x_i^{k_1}\xi_i^{(1)} = m_1,\right.$$
$$\sum_{i=1}^{n} y_i^{k_2}\eta_i^{(1)} = m_2, \sum_{i=1}^{n} x_i y_i \xi_i\eta_i = m_3\Big] P\left[\sum_{i=1}^{n} x_i^{k_1}\xi_i^{(2)} = m_1',\right.$$
$$\left.\sum_{i=1}^{n} y_i^{k_2}\eta_i^{(2)} = m_2', \sum_{i=1}^{n} x_i y_i \xi_i'\eta_i' = m_3'\right],$$

where (M) designates the following summing conditions:

1) summation is carried out by all $m_i \geqslant 0$, $m_i' \geqslant 0$;

2) $m_1 + m_2 + m_3 \leqslant k_1$, $m_1' + m_2' + m_3' \leqslant k_2$;

3) $m_4 = m_1 - m_1' - m_3' \geqslant 0$, $m_5 = m_2 - m_2' - m_3' \geqslant 0$.

The last expression for v is not difficult to calculate; as a result we obtain $(m_4 = k_1 - m_1 - m_2 - m_3,\ m_4' = k_2 - m_1' - m_2' - m_3')$.

$$v = \sum_{(M)} \frac{n_1! k_2!}{m_1! m_2! m_3! m_4! m_1'! m_2'! m_3'! m_4'!} \left(\frac{\sum_{i=1}^{n} x_i}{n}\right)^{m_1 + m_1'} \times$$
$$\times \left(\frac{\sum_{i=1}^{n} y_i}{n}\right)^{m_2 + m_2'} \left(\frac{\sum_{i=1}^{n} x_i y_i}{n}\right)^{m_3 + m_3'} \times$$
$$\times \left(1 - \frac{\sum_{i=1}^{n} x_i - \sum_{i=1}^{n} y_i}{n}\right)^{m_4 + m_4'} -$$

$$-\sum_{(M)} \frac{k_1!k_2!}{m_1!m_2!m_3!m_4!m_1'!m_2'!m_3'!m_4'!}(a-r)^{m_1+m_1'}(b-r)^{m_2+m_2'}\times$$

$$\times r^{m_3+m_3'}(1-a-b+r)^{m_4+m_4'}, \qquad (5)$$

$$a=\int_0^1 f(x)\,dx;\quad b=\int_0^1 g(x)\,dx;\quad r=\int_0^1 f(x)\,g(x)\,dx.$$

From equation (5) is evident that v = $\overset{*}{\gamma}$ (r) since formula (3) changes into formula

$$E\mu_0=\sum_{k=1}^{m_1}\sigma^*\left[\int_0^1 f_k^+ g\,dx\right]-\sum_{k=1}^{m_0}\sigma^*\left[\int_0^1 f_k^- g\,dx\right]. \qquad (6)$$

which proves our theorem.

Continuous perceptron with threshold A-elements.

We will examine a perceptron with discrete meshing, consisting of n percepting elements, for which acoidental values $\psi(s_i)$ $\xi_i^{(n)}$ are independent and distributed identically. This type of perceptron is considerably different from the Rozenblat perceptron in which, apparently, ξ_i are independent.

Let us imagine that the meshwork - is a section (0.1) divided into n equal intervals. We will discuss accidantal values $\xi_i^{(n)}=\xi_i\sqrt{n}$ where ξ_i are independent and distributed identically; $\xi_i^{(n)}$, apparently, also possesses this characteristic. Next we will assume that $E\xi_i=0$, $E\xi_i^2=1$. We will begin increasing n, i.e., to fractionate the meshing into all much smaller numbers (elements). The accidental value $\frac{1}{n}\sum_{i=1}^{n}\xi_i^{(n)}$ by force of the Lyapunov theorem tends to a certain maximum, which appears

to be a normally distributed accidental value: we will designate $\lim_{n\to\infty}\frac{1}{n}\sum_{x_i\in(\alpha,\beta)}\xi_i^n$ by $\int_\alpha^\beta \xi(x)\,dx$. For nonintersecting intervals of "integration," these accidental values are independent; in this way, we deal with a Wiener accidental process. We will designate $\lim_{n\to\infty}\frac{1}{n}\sum_{i=1}^{n}\xi_i f(x_i)$, which for function f from L_2 exists by the Lyapunov theorem within $\int_0^1 f(x)\xi(x)\,dx$, and we will discuss the generalized incidental process $\Phi(f)=\int_0^1 f(x)\xi(x)\,dx$. Process $\Phi(f)$, apparently, appears to be a product of the generalized Wiener process $\Phi_0(f)=\int_0^1 f(t)\left[\int_0^t \xi(x)\,dx\right]dt$. As is shown in report [3], this is a Gaussian generalized process, its correlation functional

$$B(f,g)=\begin{pmatrix}\int_0^1 f^2dx & \int_0^1 fg\,dx\\ \int_0^1 fg\,dx & \int_0^1 g^2dx\end{pmatrix} \qquad (7)$$

We will turn to discuss signal μ_0. Just as for the Rozenblat perceptron, by virtue of independence of incidental functions for various A-elements takes place theorem I, leading us to the investigation of $E\mu_0$. For the general case of generalized Gaussian incidental processes, this investigation was conducted by [1]. In our case

$$E\mu_0=\sum_{k=1}^{m_1}\sigma^*\left(\int_0^1 f_k^+ g\,dx\right)-\sum_{k=1}^{m_2}\sigma^*\left(\int_0^1 f_k^- g\,dx\right). \qquad (8)$$